Unit 3: Problem Solving (LEVEL 3)

Learning outcomes

By completing this unit candidates will develop a thorough knowledge and understanding of techniques available for the analysis and presentation of numerical data.
Candidates will produce evidence to meet the unit assessment objectives in order to show that they understand how to:

- define a statistical problem to be investigated
- design and carry out a data collection activity
- collect data and use spreadsheet software to store the data
- use spreadsheet software for data analysis
- create suitable graphs/charts
- present the results of the study.

It is anticipated that a candidate will require 60 guided learning hours to complete this unit.

Assessment objectives	Knowledge, understanding and skills
1 Define a statistical problem to be investigated	• identify the problem • explain background to the problem • set a hypothesis eg 'Young people with Internet access at home do better at school' • identify project objectives and success criteria • identify data to be collected and the method(s) of processing • demonstrate an awareness of the Data Protection Act 1998
2 Design and carry out a data collection activity	Design the data collection activity: • research method – qualitative, quantitative • data collection method – eg questionnaire, data logging equipment • sample - method eg cluster, quota, random, stratified, etc - frequency and interval - size • potential errors • hardware and software required Collect data

Assessment objectives	Knowledge, understanding and skills
3 Collect data and store it using a spreadsheet	• create a spreadsheet interface that could be used to collect the data required eg data form, linked worksheet • set validation to reduce data entry errors • use suitable tools to protect the collected data: eg - locking/protecting cells - password protecting files • back up files
4 Create a suitable spreadsheet to analyse the data	• choose appropriate layout • label the spreadsheet appropriately with titles, labels, header/footer • apply appropriate formatting to display on-screen and printed results clearly eg - formatting of data types, cells, sheets - formatting style(s), - conditional formatting, - hiding/unhiding rows/columns, setting row/column width, setting background/text colours to hide data - group/ungroup • use tools to improve the efficiency of the spreadsheet eg - linking cells between different worksheets, - absolute and relative cell referencing - macros • filter/autofilter • use appropriate formulae eg - simple mathematical formulae using operators such as add, subtract, divide, multiply - more complex formulae eg percentages, use of brackets, two stage calculations • use appropriate functions to summarise and analyse the data - statistical functions eg SUM, AVERAGE, MIN, MAX, COUNT, COUNTIF - logical functions eg IF, OR, AND • check and test the spreadsheet to ensure that it works effectively
5 Create suitable graphs/charts	Appropriate use of a range of chart types: eg • pie charts • comparative bar/column, line-column charts • comparative line graphs • scatter graphs • trend lines, linear relationships Appropriate chart presentation techniques: • choice of legend and heading • formatting and labelling axes, data series and data points • scale applied to numerical axes

Assessment objectives	Knowledge, understanding and skills
6 Present findings to an audience	Present the findings of the study The presentation to include • tables • graphs/charts • text or detailed commentary • how well the results of the study: - supported or disproved the hypothesis - met the identified success criteria

Assessment

This unit is centre assessed and externally moderated.

In order to achieve this unit, candidates must produce a portfolio of evidence showing that they have met all of the assessment objectives.

Portfolios of work must be produced independently. They will need to be made available, together with witness statements and any other supporting documentation, to the OCR Visiting Moderator when required.

Centres must confirm to OCR that the evidence produced by candidates is authentic. An OCR Centre Authentication Form is provided in the Centre Handbook and includes a declaration for assessors to sign. It is a requirement of the QCA Common Criteria for all Qualifications that proof of authentication is received.

Guidance on assessment and evidence requirements

Candidates may provide portfolio evidence for this unit using a range of suitable and appropriate techniques. These may include written data, the use of video, audio presentation and slide show presentations within the body of the portfolio and display evidence. Where presentations or displays have taken place for which evidence cannot be easily included within the portfolio evidence assessor testimony/witness statements must be included, signed by the assessor(s), and supported by appropriate evidence (handouts, slides etc). Centres may wish to organise a link with local business and write an assignment accordingly. This may be useful in the early stages of the course.

An OCR model assignment is available for this unit and can be downloaded from our website: www.ocr.org.uk and can also be found in the Model Assignments folder on the CD-ROM.

For Assessment Objective 1, the problem might be given to the candidates in general terms, but they should then carry out their own initial investigations and set their own hypotheses. For example, they might be asked to investigate some of the social effects of the Internet on young people. They would then use sources such as the World Wide Web to find out some of the main issues and set themselves hypotheses, such as 'Young people with access to the Internet at home do better at school' and/or 'Young people who spend more than 1 hour a day using the Internet are less fit than those who don't'. Merit and Distinction candidates should set more complex hypotheses, which consider whether other factors, eg the age group of the young person, affect the result, requiring more complex analysis. It is likely that many candidates, especially at the higher levels, will come up with more than one hypothesis.

Candidates should be able to define the sort of information they need to find out in order to support or disprove their hypotheses. Some of this information might come from existing surveys, and information from publications such as Social Trends. However, the majority of the information will need to come from primary research, eg questionnaires. Candidates will need to identify the criteria that will be used to test the hypothesis. They will need to consider what the spreadsheet is required to do: the input, processing of data and the output required eg the type of graphs or charts that would be most suitable. There may be additional user requirements eg details of user aids, such as drop down lists and forms, to help the input, which will also need to be included. However, detailed plans for the spreadsheet itself are not required.

Although candidates need to comply with data protection legislation there is no need for them to demonstrate detailed knowledge of, for example, Data Protection principles, rather they should understand that statistical data does not require the collection, storage or processing of personal data as defined in data protection legislation. Whilst this must be considered at the beginning of the work, candidates must also demonstrate in work throughout the unit that they understand these requirements by complying with the requirements in their data collection, storage and analysis.

If data is collected electronically then work for Assessment Objectives 2, 3 and part of 4 might be carried out simultaneously, although each objective must be assessed separately.

Assessment Objective 2 requires candidates to design and implement a data collection strategy. At Pass level candidates' choice of method might include some data of limited usefulness. At Distinction level candidates' strategies will ensure that appropriate data is collected and is stored in a way that will protect the anonymity of the data subjects.

Where data is to be collected over a time period, the sample interval and/or frequency should be defined by Distinction candidates.

Assessment Objective 3 requires candidates to create a spreadsheet and enter and store the collected data. Candidates will need to ensure that the inputs to the spreadsheet match the collected data. They will need to consider how the data is going to be input and this will largely determine the type of interface designed. Where data is to be entered manually into the spreadsheet, an effective interface, required at the higher levels, would be a form, with macros to insert the data into the main sheet(s) and to reset the form. The layout of this form and other features such as drop-down boxes will determine how easy to use it is.

Consideration will also need to be given to how the data is going to be protected from unauthorised access, alteration and loss. This should include a range of worksheet/workbook protection as well as file security options (eg protection against opening and editing).

Validation and password/cell protection can be evidenced from the electronic file but candidates should make clear where such features have been used. If hard copy evidence is relied upon screenshots must be produced to show the measures taken.

In Assessment Objective 4 candidates must create and use a spreadsheet to analyse their results. There is no specific requirement for the spreadsheet workbook to contain more than one sheet, although higher level candidates might choose to organise their data across a number of sheets, perhaps putting summary tables on separate sheets.

The statistical element of analysis may not be particularly advanced, as there is no requirement for candidates to have any advanced understanding of statistics. However, Distinction candidates should compare results across subgroups within the sample. For example, whilst Pass candidates might find the average number of hours spent using the Internet, Merit and Distinction candidates might also find the average number of hours spent by males and females and Distinction candidates might go on to compare these figures with the average number of hours spent by males and females in different age groups.

Candidates should provide, as a minimum, evidence that they have tested the formulas in their spreadsheets by using test data that makes the results easy to check, by estimating the results and checking that the actual results are of the same order as the estimate or by using manual calculations or a calculator to work out what the result should be. Higher level candidates should provide a detailed test specification which tests all aspects of the spreadsheet, including input of data, validation and functions used.

For Assessment Objective 5, candidates are required to produce charts/graphs that provide some useful information relevant to the hypothesis. All candidates at this level need to produce charts that display the data effectively, with consideration to the different requirements of discrete and continuous data. At higher levels candidates are required to demonstrate their understanding of why their choices of chart/graph types are appropriate.

There is a requirement at Distinction level to create three different types of chart, but these also must be appropriate and relevant. If a candidate decides that by using the most appropriate types of chart for the data they have collected they will use less than this, they might provide further

evidence of creating different types of charts, with explanations of why these were eventually rejected.

Assessment Objective 6 requires candidates to prepare a presentation of their findings, which might be as a slide-show presentation to accompany a talk, as a website or as a written report. If candidates choose to use presentation software, detail is most likely to be provided by speaker notes/commentary.

Assessment Objective	Pass	Merit	Distinction
AO1 Define a statistical problem to be investigated	Candidates will describe the background to the problem. They will set a simple hypothesis and list some criteria to be used to test it. They will identify some of the data that needs to be collected and briefly explain how it will be processed. They will demonstrate an understanding of Data Protection legislation and give a brief explanation of how they will comply with this.	Candidates will clearly describe the background to the problem. They will set a complex hypothesis and clearly describe criteria that will be used to test it. They will identify the data that needs to be collected and explain how it will be processed. They will demonstrate an understanding of Data Protection legislation and explain how they will comply with this.	Candidates will explain thoroughly the background to the problem. They will set a complex hypothesis and clearly describe and justify the criteria that will be used to test it. They will identify the data that needs to be collected and explain clearly how it will be processed. They will demonstrate an understanding of Data Protection legislation and explain how they will comply with this.
AO2 Design and carry out a data collection activity	Candidates will plan and carry out a data collection activity to gather some suitable data for their investigation. The plan will include a suitable sampling method. Candidates will list some of the constraints that could affect the reliability of their study. They will collect some useful data.	Candidates will plan and carry out a data collection activity to gather a range of suitable data for their investigation. The plan will include a suitable sampling method and size. Candidates will describe most of the constraints that could affect the reliability of their study and identify some areas of potential error in their sampling regime. They will collect the data identified.	Candidates will plan and carry out a data collection activity to gather the data that is necessary for their investigation. They will make appropriate use of research and data collection methods. The plan will include a suitable sampling method and size, and frequency/interval if appropriate, with justification of choices. Candidates will describe the constraints that could affect the reliability of their study and identify areas of potential error in their sampling regime. They will explain the steps they have taken to eliminate bias from their study. They will collect the data identified.

Assessment Objective	Pass	Merit	Distinction
AO3 Collect data and store it using a spreadsheet	Candidates will create a simple interface for entering data into a spreadsheet. They will include at least one suitable validation routine to limit data entry errors. They will store some useful data.	Candidates will create an effective interface for entering data relevant to their research into a spreadsheet. They will include suitable validation routines to limit data entry errors for most items of data where this is appropriate. They will store the data collected and take at least one measure to ensure its security. They will demonstrate an understanding of the need for security measures.	Candidates will create an effective and easy-to-use interface for entering data relevant to their research into a spreadsheet. They will use a range of effective validation methods to minimise data entry errors wherever possible. They will store the data collected and protect it from unauthorised access and from accidental and deliberate change and loss. They will demonstrate a thorough understanding of the need for security and the range of measures that are needed.
AO4 Create a suitable spreadsheet to analyse the data	Candidates create a structure to analyse and present the results of their study. They will apply appropriate titles, labels and formatting to display most information clearly. They will use appropriate functions to analyse some of the data, providing some useful data relevant to the hypothesis. They will carry out at least one test of their spreadsheet and use the results to make changes, if appropriate.	Candidates create an effective structure to analyse and present the results of their study. They will apply appropriate titles, labels and formatting to display most information clearly. They will use appropriate functions to analyse the data, providing a range of useful data relevant to the hypothesis. They will devise a test plan and use it to ensure that the spreadsheet works effectively.	Candidates create an effective and efficient structure to analyse and present the results of their study. They will apply appropriate titles, labels and formatting to display all information clearly. They will use appropriate functions to carry out a thorough analysis of the data, providing a range of useful data relevant to the hypothesis. They will devise a comprehensive test plan and use it to ensure that the spreadsheet works effectively.

Assessment Objective	Pass	Merit	Distinction
AO5 Create suitable graphs/charts	Candidates will create at least one graph/chart that is relevant to their hypothesis and appropriate for the data being presented. They will use some formatting and labelling features to improve the presentation of their chart(s).	Candidates will create at least two different types of graphs/charts that are relevant to their hypothesis and appropriate for the data being presented. The choice of chart types will be briefly explained. They will use appropriate formatting and labelling features to improve the presentation of their charts.	Candidates will create at least three different types of graphs/charts that are significant to their hypothesis. The choice of chart types will be appropriate and fully explained. They will use appropriate formatting and labelling features to display the data effectively.
AO6 Present findings to an audience	Candidates will create a straightforward presentation about the findings of their data analysis. This will address their hypothesis and include at least one table of data and at least one graph/chart. They will state, with at least one reason, whether the analysis has supported or disproved the hypothesis.	Candidates will create a detailed presentation about the findings of their data analysis. This will address their hypothesis and include a range of tables and graphs/charts, formatted and presented effectively. They will explain whether the analysis has supported or disproved the hypothesis. The presentation will be mostly appropriate for the audience and purpose.	Candidates will create a comprehensive presentation about the findings of their data analysis. This will address their hypothesis and include a range of tables and graphs/charts, formatted and presented effectively. The presentation will be of near professional standard. Candidates will explain the extent to which the analysis has supported or disproved the hypothesis. The presentation will be appropriate for the audience and purpose. They will evaluate the effectiveness of the spreadsheet model.